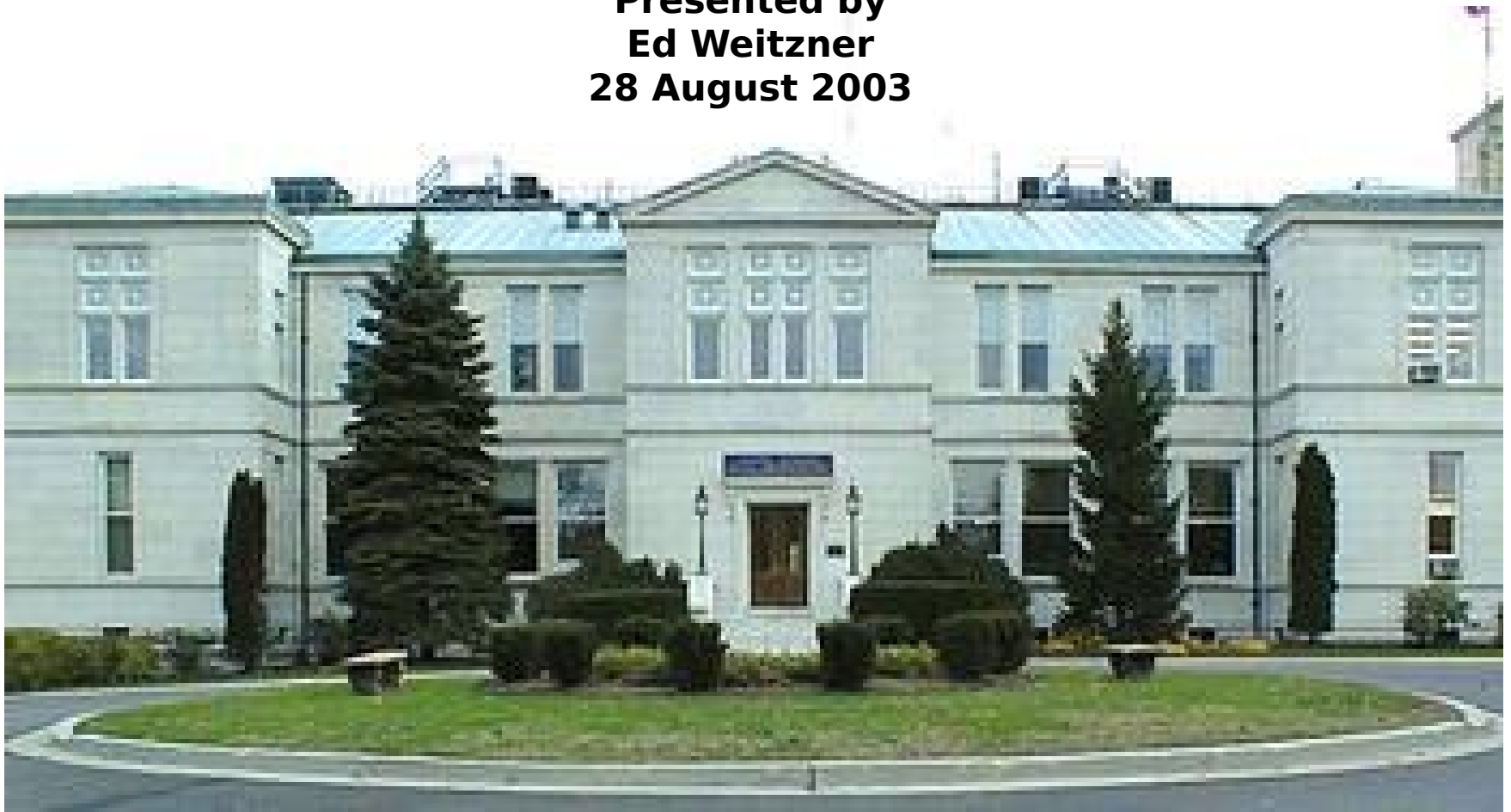
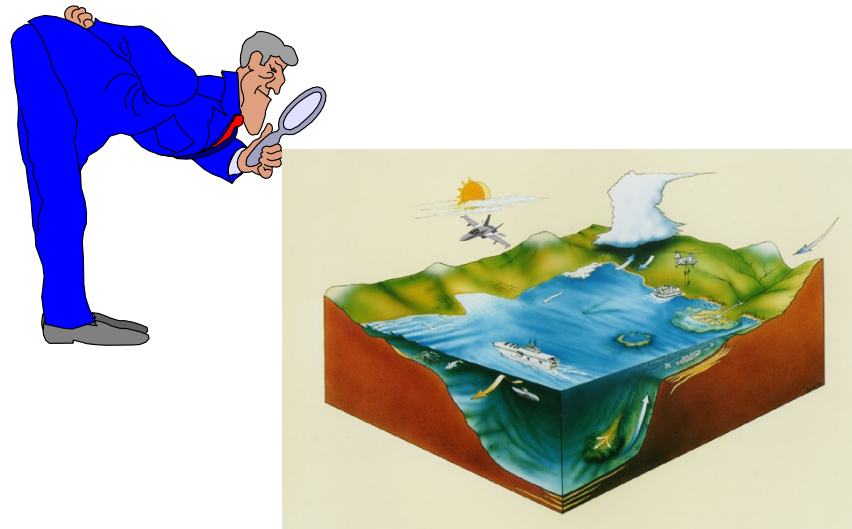


Information Brief To ASNE
on
Ocean Data Requirements
for the ESG

Presented by
Ed Weitzner
28 August 2003



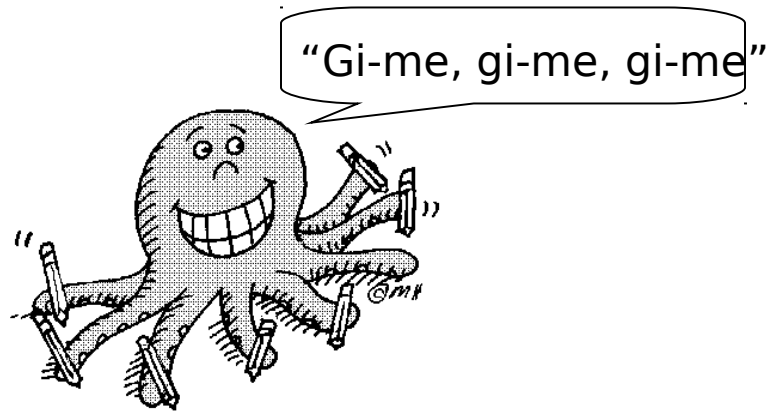
New Ocean Data Requirements for ESG



Outline

- Initial Requirements Survey
- Support to JWARS
- Support to Navy Fleet Battle Experiments
- Support to the Navy POM 06 Assessment
- Ocean Center of Excellence
- TEDServices/OASES/ESG/Data IDEF0 Model

Initial Requirements Survey



M&S Requirements Summary

Ocean Surface

- Sea state, sea spray, sea surface temperature, water temperature and survival
- Sea level pressure
- Wave speed and direction, wave height, wave spectra
- Sea ice location, depth, thickness, extent and concentration, type
- Swell height, period, direction, wavelength and refraction angle
- Icebergs
- Knuckles and wakes
- Foam and percent white cap coverage

Ocean Volume

- Ocean front and eddy locations
- Temperature/Salinity/Conductivity Profiles
- Bioluminescence and visibility
- Internal waves, tidal range, tide times, tidal currents and tidal height
- Water turbidity and light attenuation
- Water density
- Deep scattering layer depth
- Ocean current location, direction, speed, depth profile, shear, and type
- Color and composition
- Turbulence

M&S Requirements Summary

Ocean Botton

- Bottom slope, sea floor topography, trenches
- Marine magnetics
- Bottom composition and sediment type
- Water depth in open ocean, near shore and in ports, harbors and anchorages
- Compressibility, roughness, shear strength, sediment thickness and bulk density

Acoustics

- Bottom scattering
- Surface scattering
- Volume scattering
- Reverberation loss
- Bottom loss
- Surface loss
- Ambient noise
- Sound speed profiles
- Transmission loss

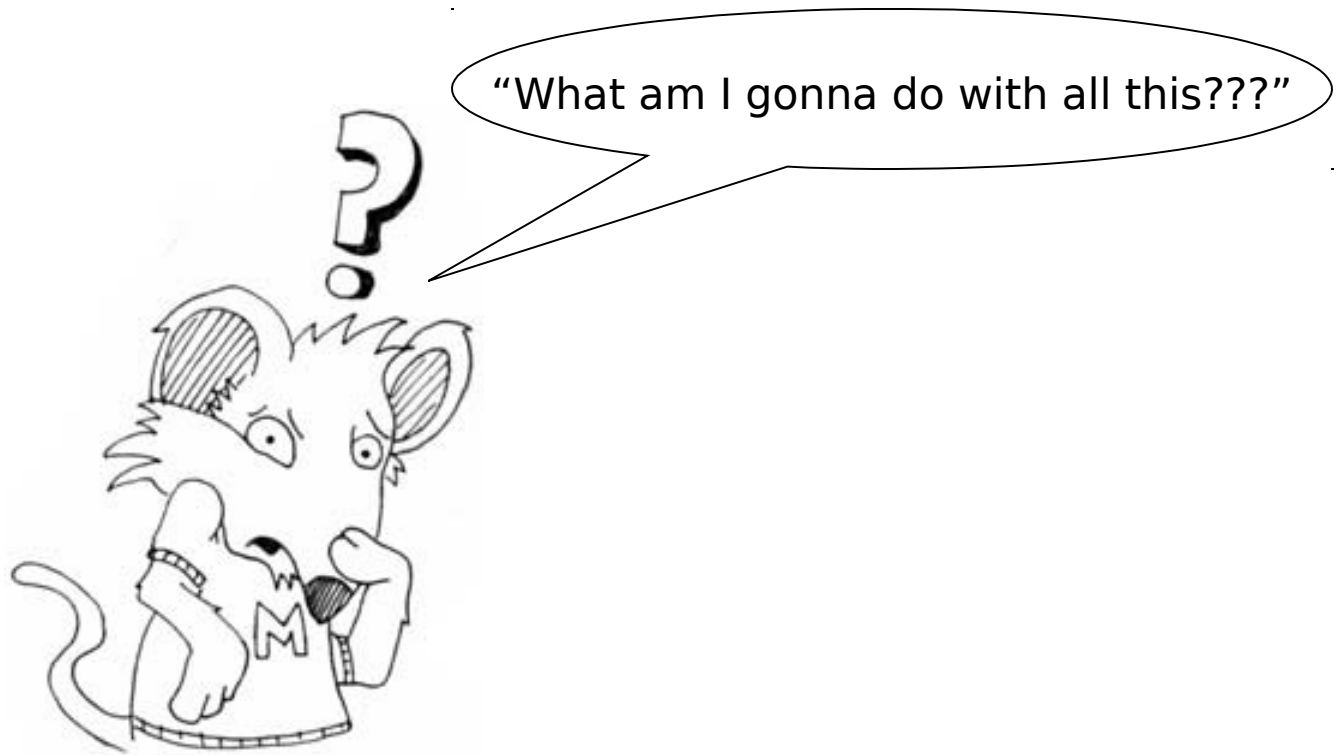
Biologics

- Marine mammals, biofoulants, attachments and entanglements
- Marine biologics such as marine mammals and snapping shrimp

M&S Requirements Summary

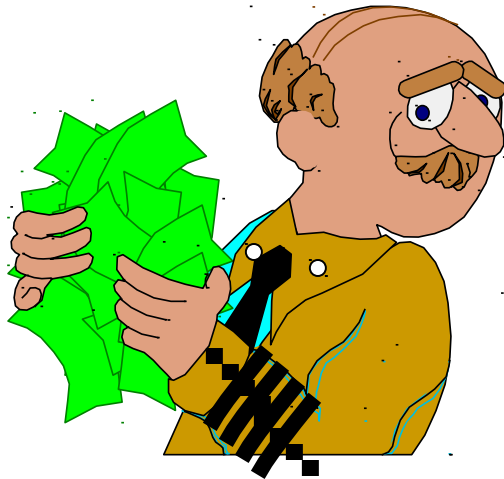
Littoral

- Coastal information such as beaches, coast type, coral reefs, shoals, bottom obstacles, man made obstructions
- Beach erosion, marches, rivers and swamps
- Beach slope, contour of the sea bottom
- Beach material (between the 3-1/2 fathom curve and the high-water line)
- Coastline configuration, vegetation, contaminants and marine mammals
- Dunes, sand bars, trenches
- Surf zone width and number of surf lines
- Significant wave steepness
- Wave period
- Wave run-up
- Wave set-up
- Breakers type and angle (dominant, maximum and significant)
- Breaker height and direction
- Breaker angle, type and period
- Breaker interval
- Harbor and port databases
- Tides, surf and tidal fluctuations



Three Examples Requiring Ocean Representation That are Currently Unsupported by **ESG**

"It's a matter of priorities."



Support to JWARS



"Dang it! I want more. And faster... faster..."

Signal Excess Equation

Passive Case Example

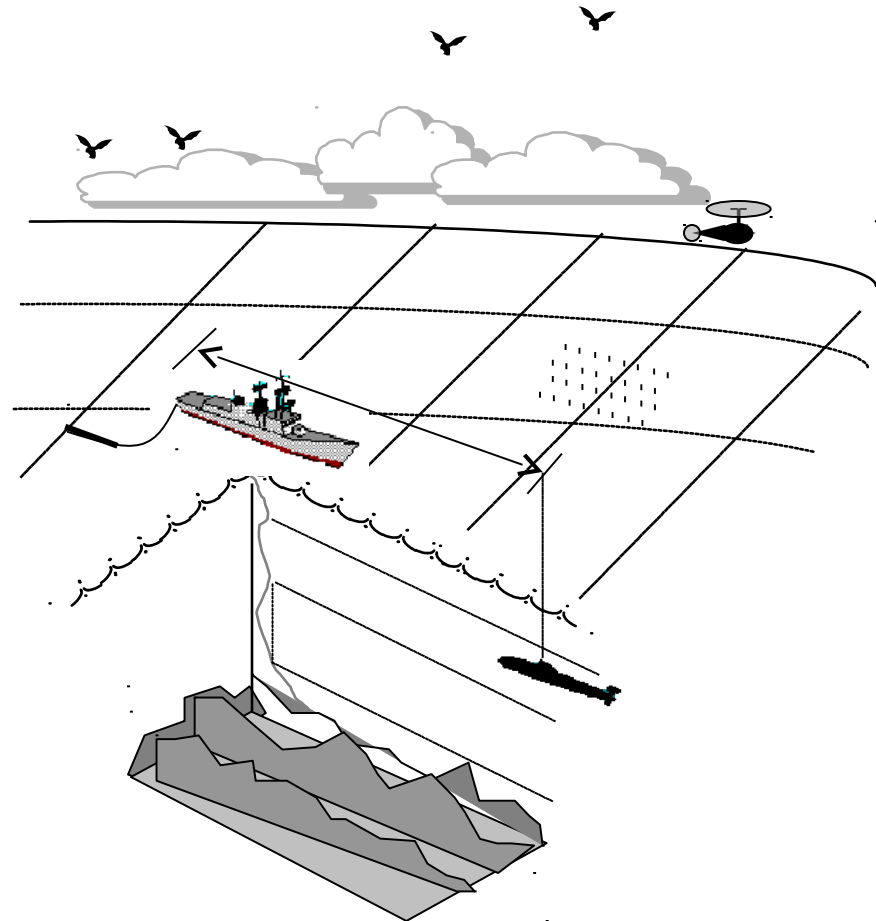
$$SE = SL - \text{TL} + AG - RD - \text{AN}$$

From the MSEAs

AN
TL

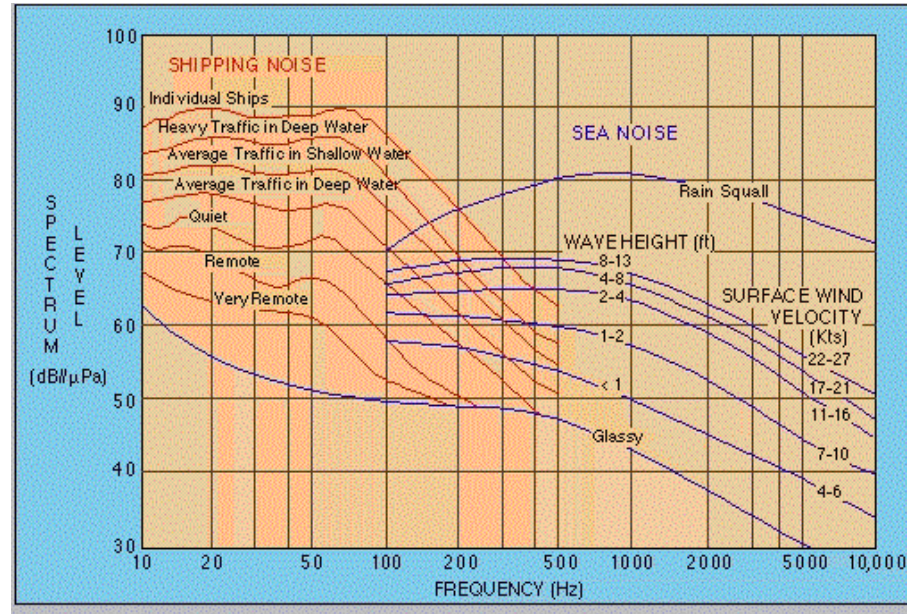
From JDS

SL
AG
RD



Ambient Noise

Wind & Precipitation Generated Noise



Wind Speed
& Precip
from
ESG

Precip
Noise

Wind
Noise

Distant Shipping Noise

Location
from
JWARS

Shipping Noise
Database
from OAML

Shipping
Noise

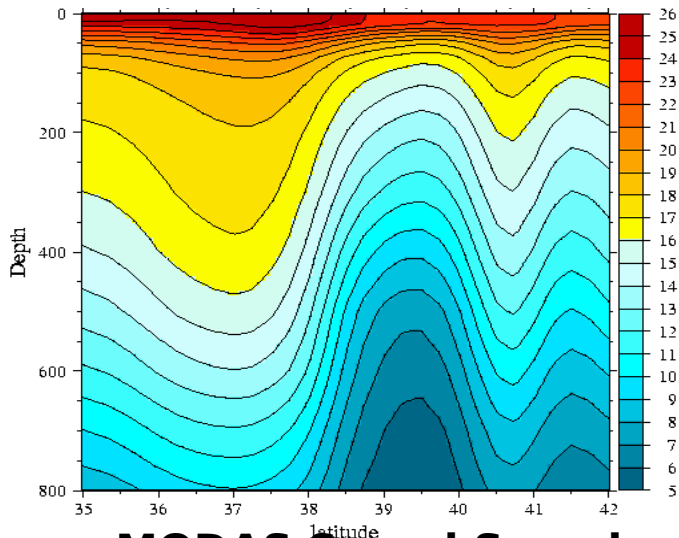
Levels
from
JDS

Total
Ambient
Noise

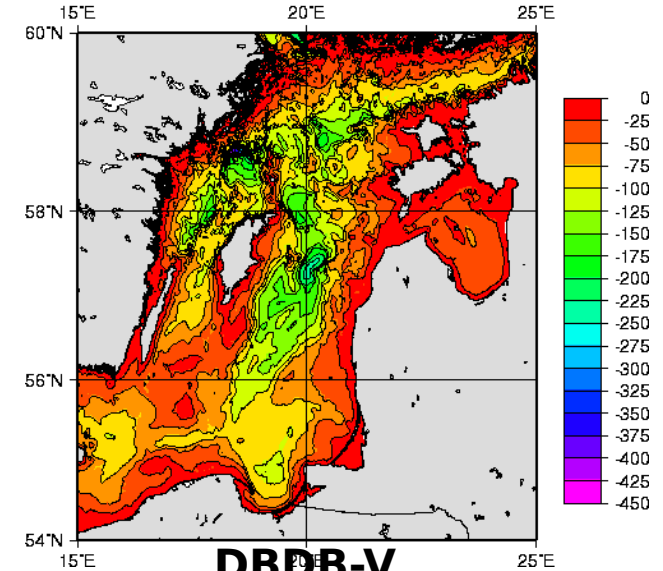
Ship Self-Generated Noise

Data Used in Modeling

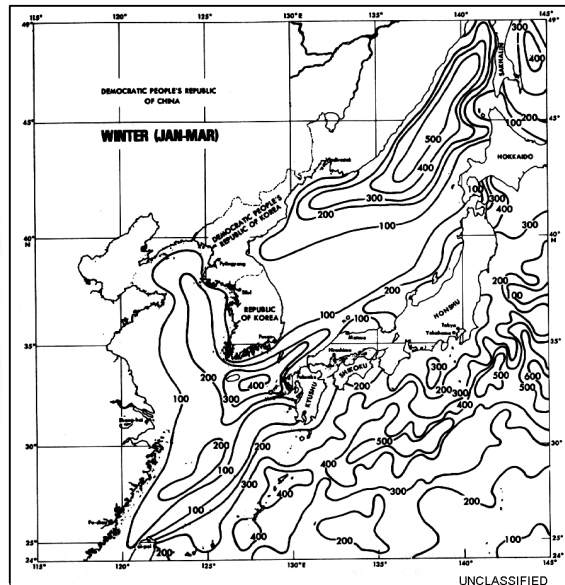
TL



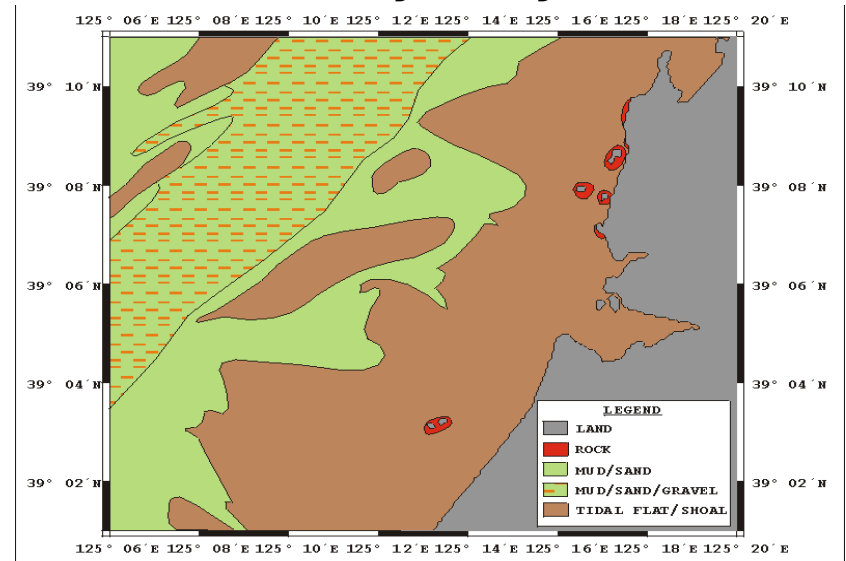
MODAS Sound Speed Profiles



DBDB-V Bathymetry

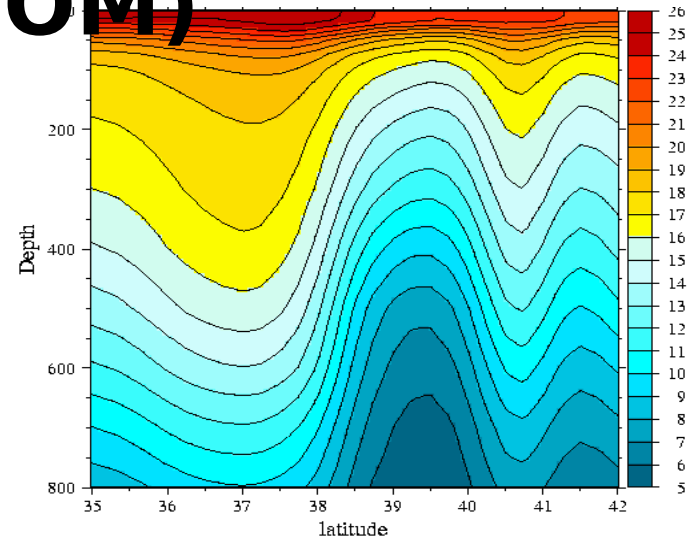
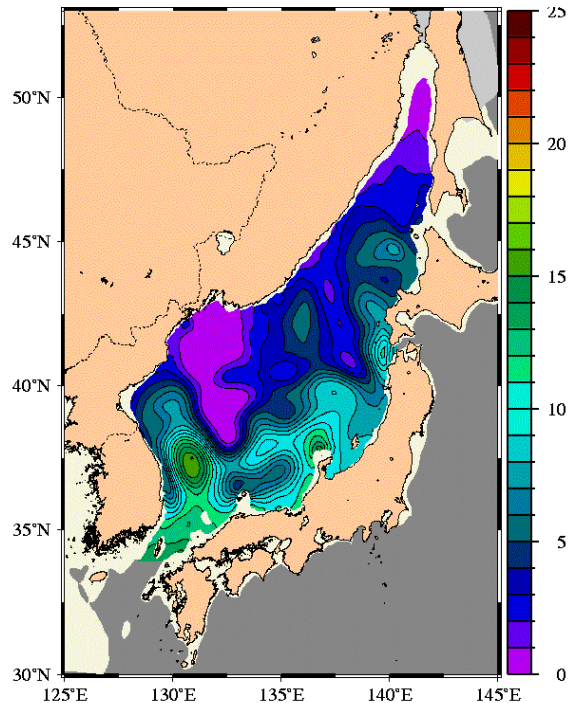


Sonic Layer Depth



Ocean Bottom Type

Modular Ocean Data Assimilation System (MODAS) and Navy Coastal Ocean Model (NCOM)



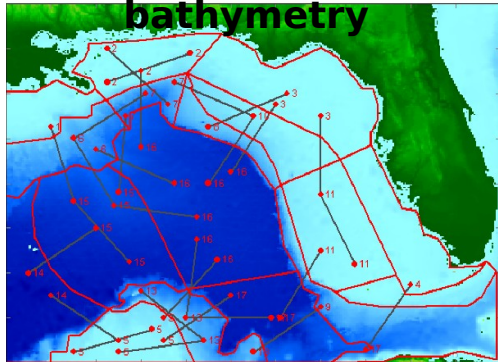
Products include:

- 3D volumes of
 - Temperature
 - Salinity
 - Sound speed
 - Currents
- 2D derived quantities of the above at
 - Arbitrary depths
 - Mixed layer depth
 - Sonic layer depth
 - Deep/shallow sound channel axes

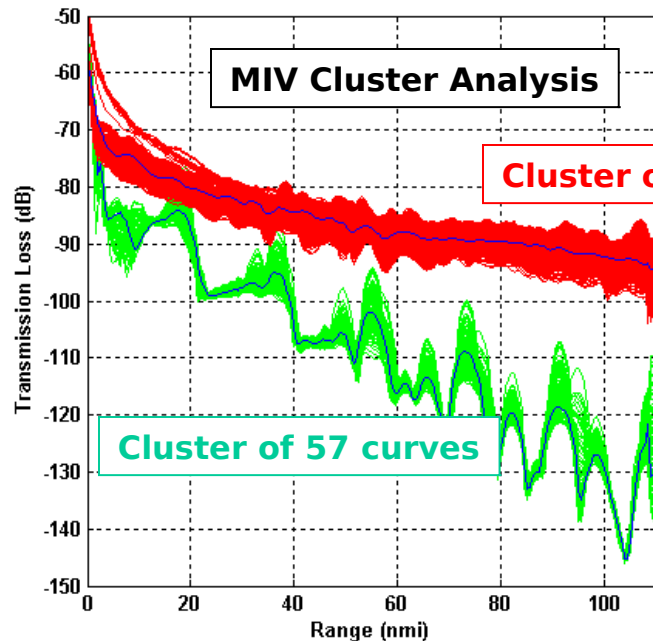
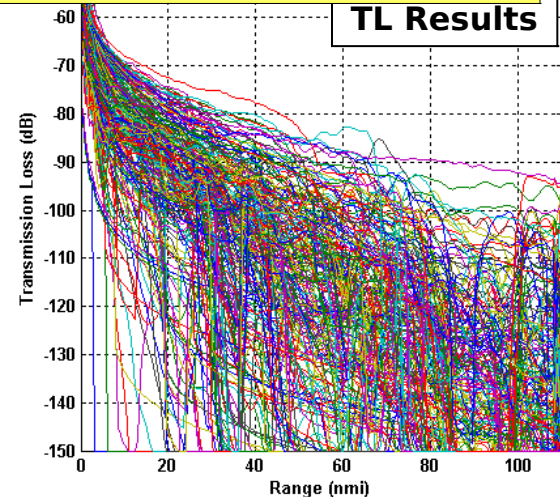
Multiresolution Interaction Validity (MIV)

A methodology for using cluster analysis to characterize the way in which an environmental effects model (e.g. acoustic propagation) responds to a particular environment.

Feature-areas
overlaid on
bathymetry



Generate acoustic
transmission loss
(TL) for multiple
representative
propagation paths
within exercise area
(**7,000,000** TL curves for
NEAsia)



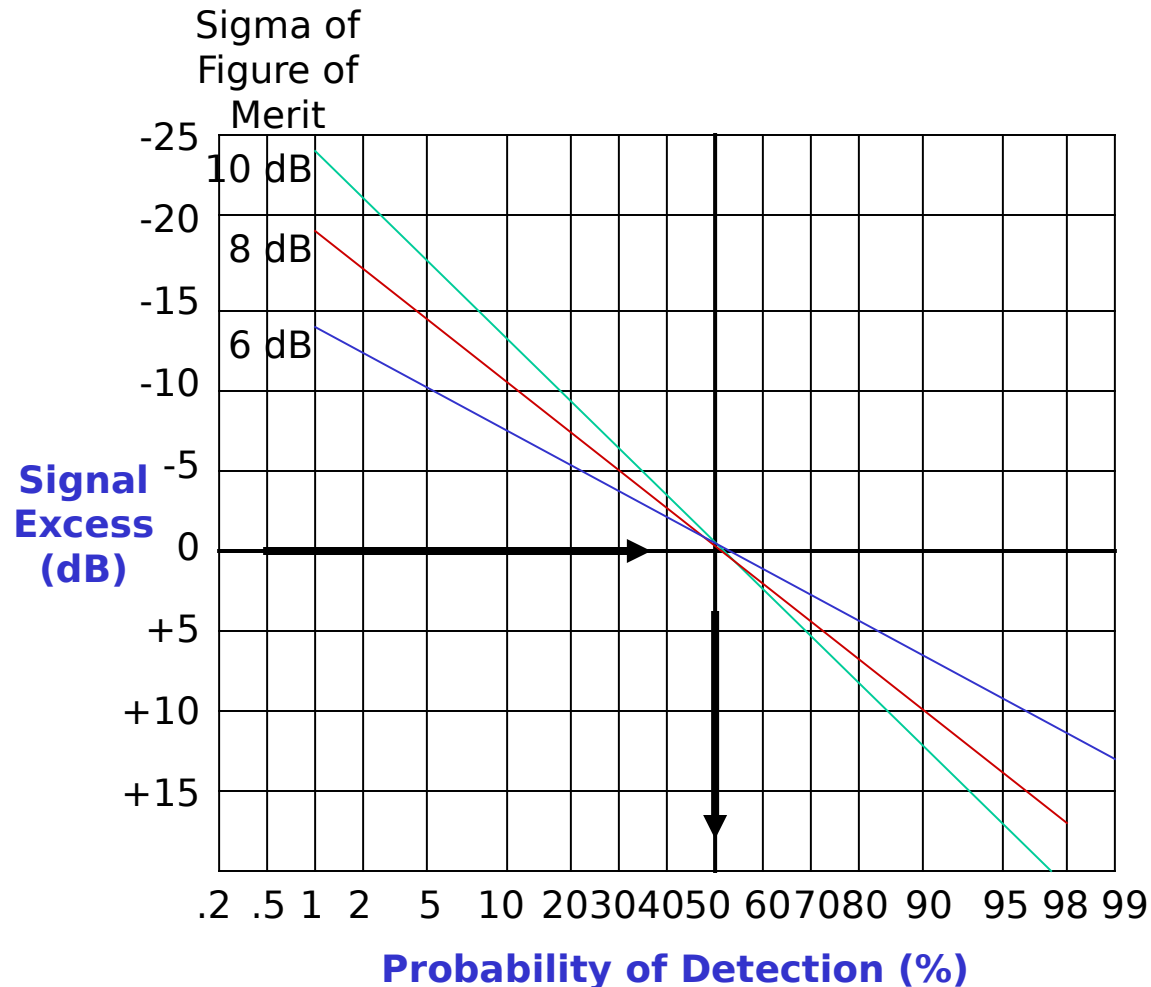
Compact TL Library
(say, **250** TL curves)
representing entire
range of TL
behaviors

TL
Directory

Probability of Detection

$$SE = SL - TL + AG - RD - AN$$

$$SE = 150 - 90 + 5 - (-10) - 75 = 0$$



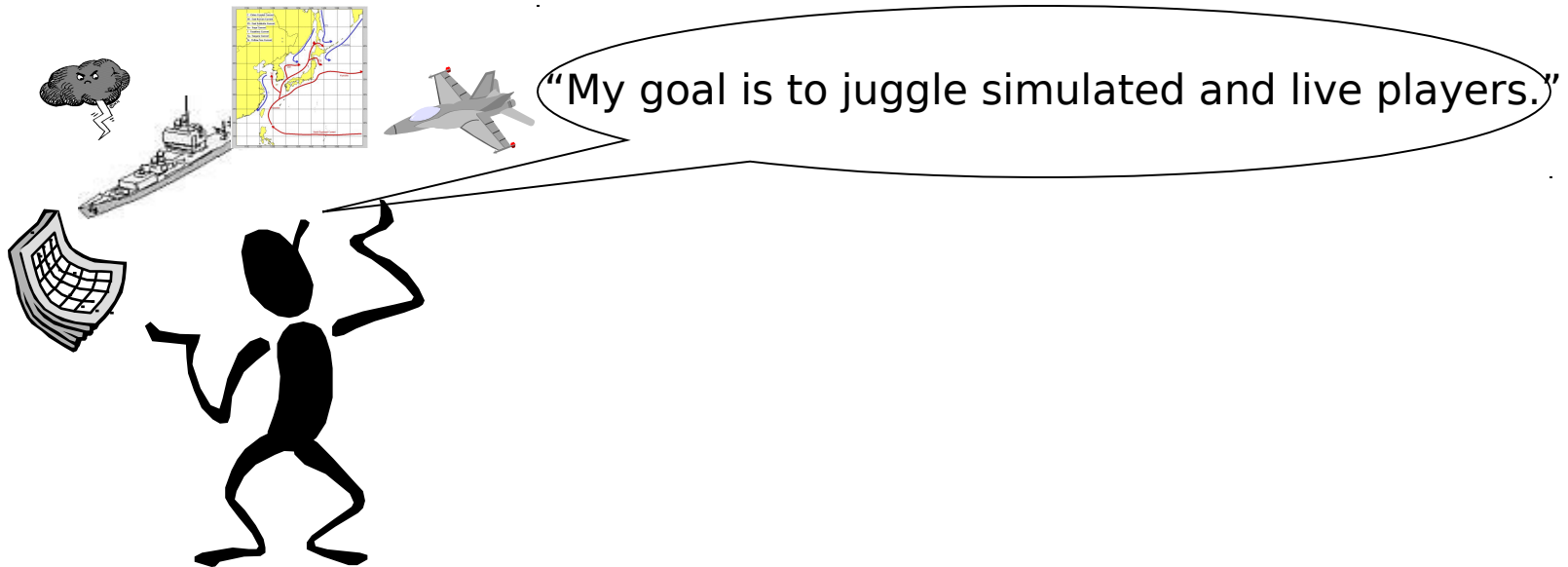
Ocean Data Providers

Data	Provider
<ul style="list-style-type: none">• Sound Speed Profiles• Shipping Noise• Wind Noise• Precipitation Noise• Transmission Loss	<ul style="list-style-type: none">• Naval Research Lab (MODAS)• Naval Oceanographic Office (OAML)• Computed by JWARS• Computed by JWARS• Naval Air Warfare Center (Sweep widths for ship-on-sub, sub-on-ship, and sub-on-sub ASW)• The John Hopkins University Applied Physics Laboratory (MIV using MODAS for aircraft-on-sub ASW)
<ul style="list-style-type: none">• Sonic Layer Depth	<ul style="list-style-type: none">• The John Hopkins University Applied Physics Laboratory (using MODAS)



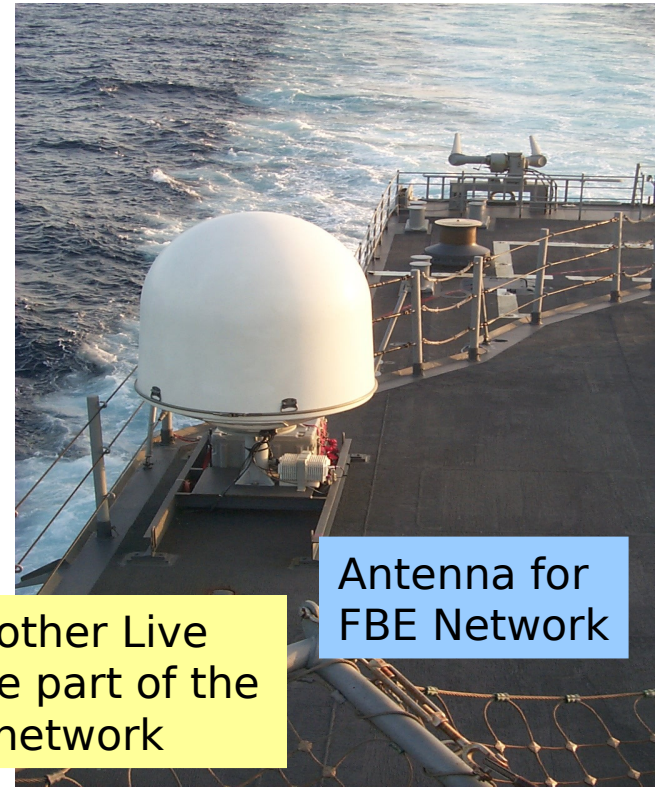
PA&E letter to ASN (RD&A) stating JWARS requirement for Ocean COE

Support to Navy Fleet Battle Experiments



Experimentation

- Objective of M&S in Fleet Battle Experiments
 - Stimulate novel C2 architecture for integration and testing
 - Produce operational scenarios to embed experimental concept/initiative
 - Provide for experimental repeatability live opportunities fail to offer
 - Prevent experimentation from being “pulled back to the present”
- Added Requirements
 - Live and simulated forces must operate in the same world
 - Operational METOC must be foundation for both live and simulated forces



Ships, other Live
Forces are part of the
FBE network

Antenna for
FBE Network

Implementation

- Use OASES to serve hourly data
- Use effects servers to mediate environmentally sensitive behaviors
- Base environmental data on operational METOC forecasts and nowcasts
 - Live forces and simulation receive same data
 - Experiment with delivery of concurrent, in-situ littoral and coastal environments

Maritime Environment for FBE's

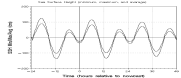
Assemble Archived Data



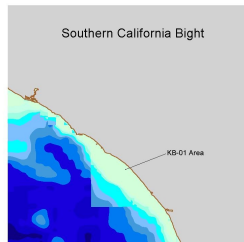
Atmosphere



Ocean

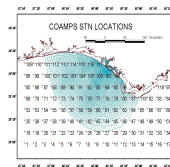


Wave Height



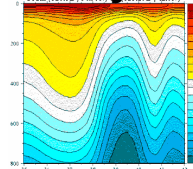
Bathymetry

Initialize Model Assimilate near Real time data



COAMPS Data

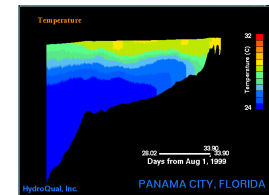
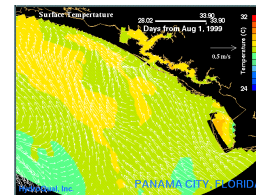
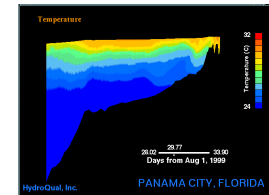
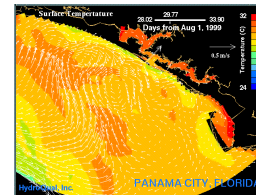
Buoy Data



**MODAS and POM
For water column**

Daily Forecast/Nowcast Process Creates Data for JSAF Simulation

Download NCOM/COAMPS Model data
SERVE Maritime Environment to FBE
Replace prior run with new data
Monitor OASES/ATLOS performance
Prepare to repeat process



Weeks before FBE

Days/hours before FBE

Daily during FBE

**Sources: NAVO,
NRL/SSC, MEL**

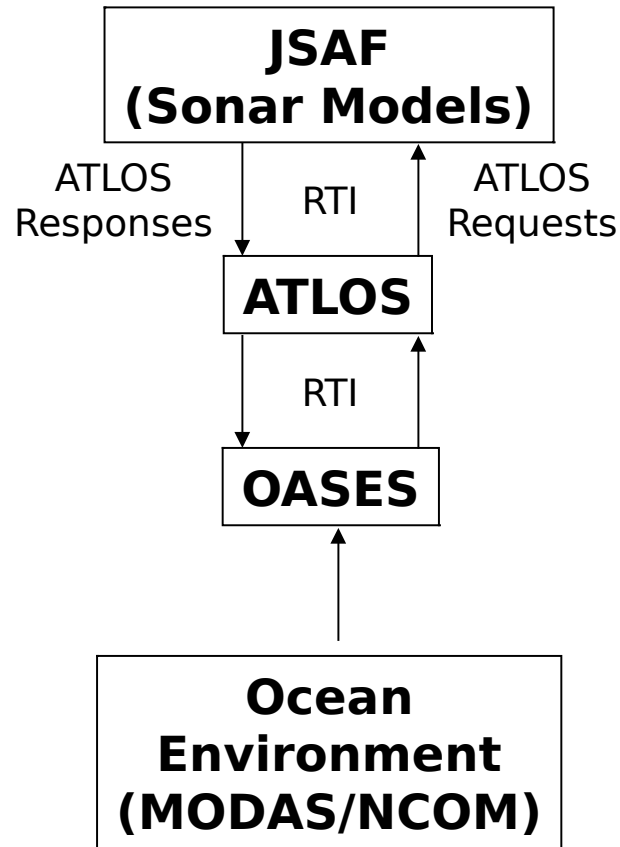
**Sources:
NAVO,
NRL/SSC**

**Required Work: Design Methodology,
Modify Server, Enable Simulated Sensor**

Coordinating Activities

- NAVOCEANO
- NRL Stennis
- NRL DC
- DMSO
- FNMOC Monterey
- NPMOC SD/Yoko
- SPAWARS

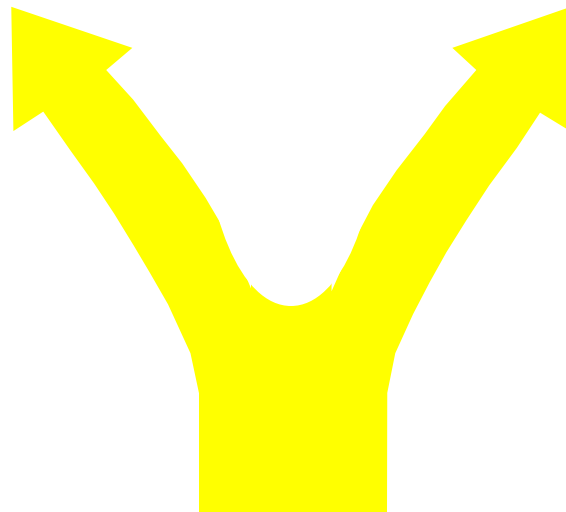
ATLOS / OASES / JSAF Dataflow



Support to the Navy POM 06 Assessment

Used in model

Used for effects



Environmental Data

Support to Navy POM 06 Assessments

Model	Data	Use
ITEM	Cloud Cover Analysis	Percent of sky obscured by clouds as seen from an observer on the ground. Data is for March to June in 1997 and 1998 for the Korean Peninsula.
	Frontal Analysis for fog, wind speed cloud cover	Analysis of the periodicity of frontal passages over the Korean Peninsula. Effects of the front are described for several sensors. Data is for March through June time frame.
COSMOS	Cloud cover data by month	Clear (0/8) to completely clouded over (8/8) over Korea based on climatology in the Global Maritime Climatic Atlas for Feb through June.
	IWEDA rules for NO GO conditions	Percentage of time sensors, weapons or weapon systems can't be used in the Korean environment.

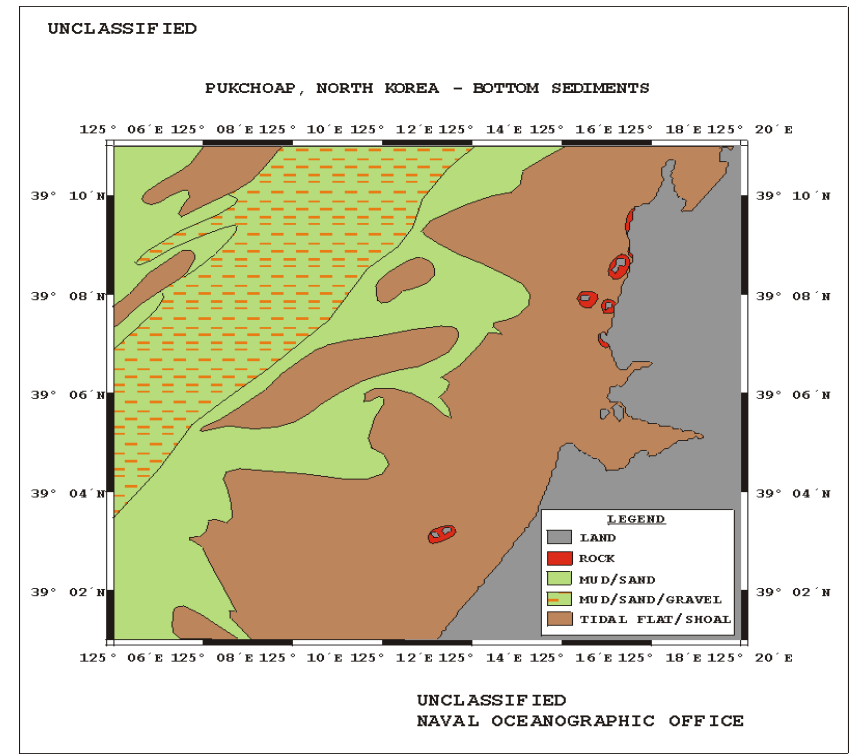
Support to Navy POM 06 Assessments

Model	Data	Use
GCAM	<ul style="list-style-type: none"> • Ocean frontal passage images and analysis for the Sea of Japan. • Time intervals for when waters surrounding Korea are => sea state 5. • MIV data (clustered MODAS data). 	ASW
	<ul style="list-style-type: none"> • Environmental information along Q-routes • Bottom type • Bathymetry • Mine impact burial data • Yellow Sea Optical Model Data (An optical model that is sensitive to Yellow Sea conditions. It provides swimmer visibility and water clarity information. • Shipping Routes and Density • Wrecks and Obstructions (Wreck locations and descriptions) • SAIL (Special Analyzed Image - Littoral) image and bottom composition chart • FLENUMMETOC DET Asheville overall summary of the Korean Peninsula environment by month. 	MIW

Support to Navy POM 06 Assessments

Model	Data	Use
USMC	<ul style="list-style-type: none">• Wrecks and Navigation hazards• Fishing zones• Shipping routes• Tide ranges, Ebb and flood tides• Ice conditions• Occurrence of breakers• Current tables / Winter/summer surface circulation• Sat photos• Modeled surf parameters• General bathymetry• Bottom materials and Surface sediment• Coastal features• Mud flats• Vegetation table	EXW

Mud Flats and Expeditionary Warfare

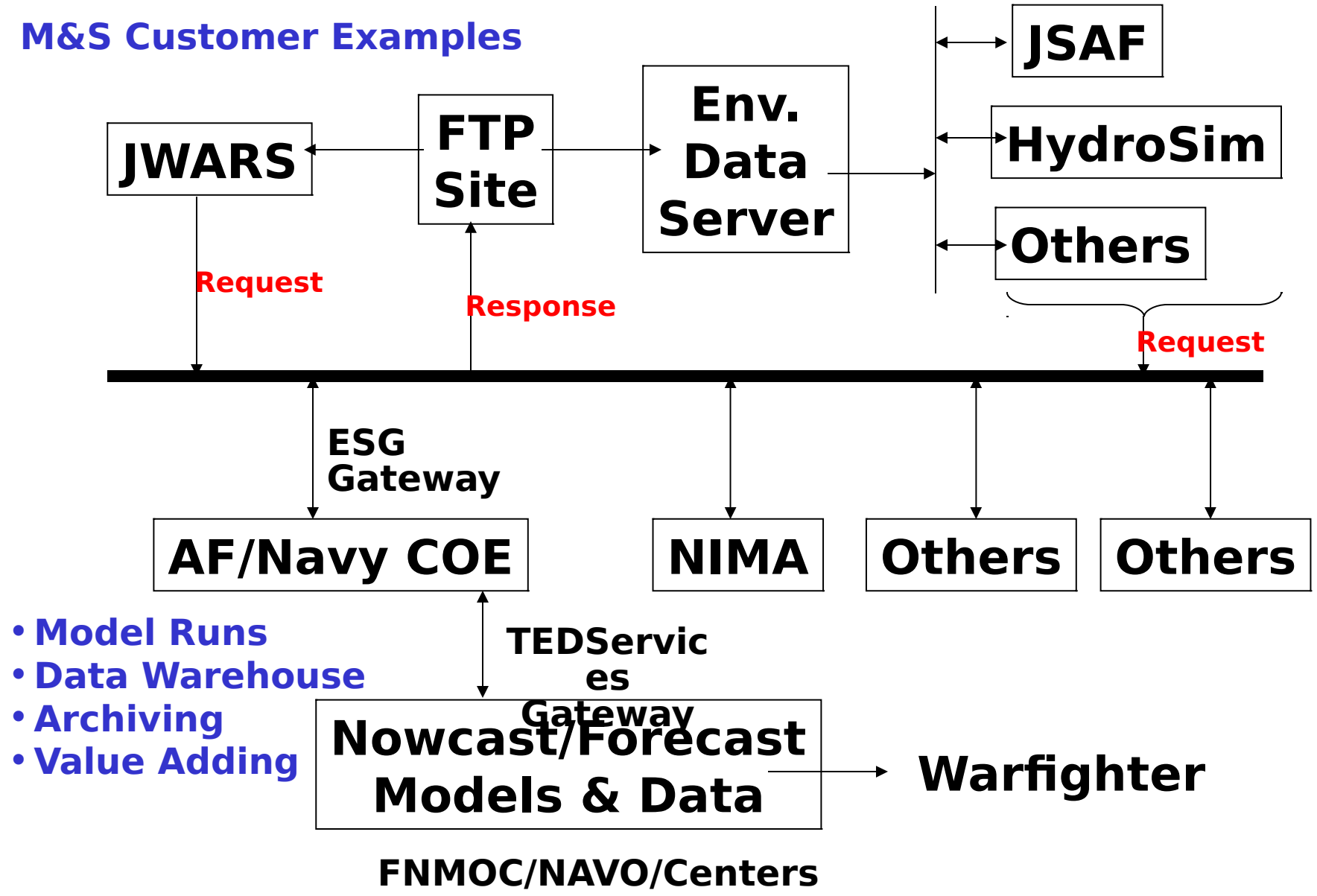


M&S Center of Excellence for Ocean Representation

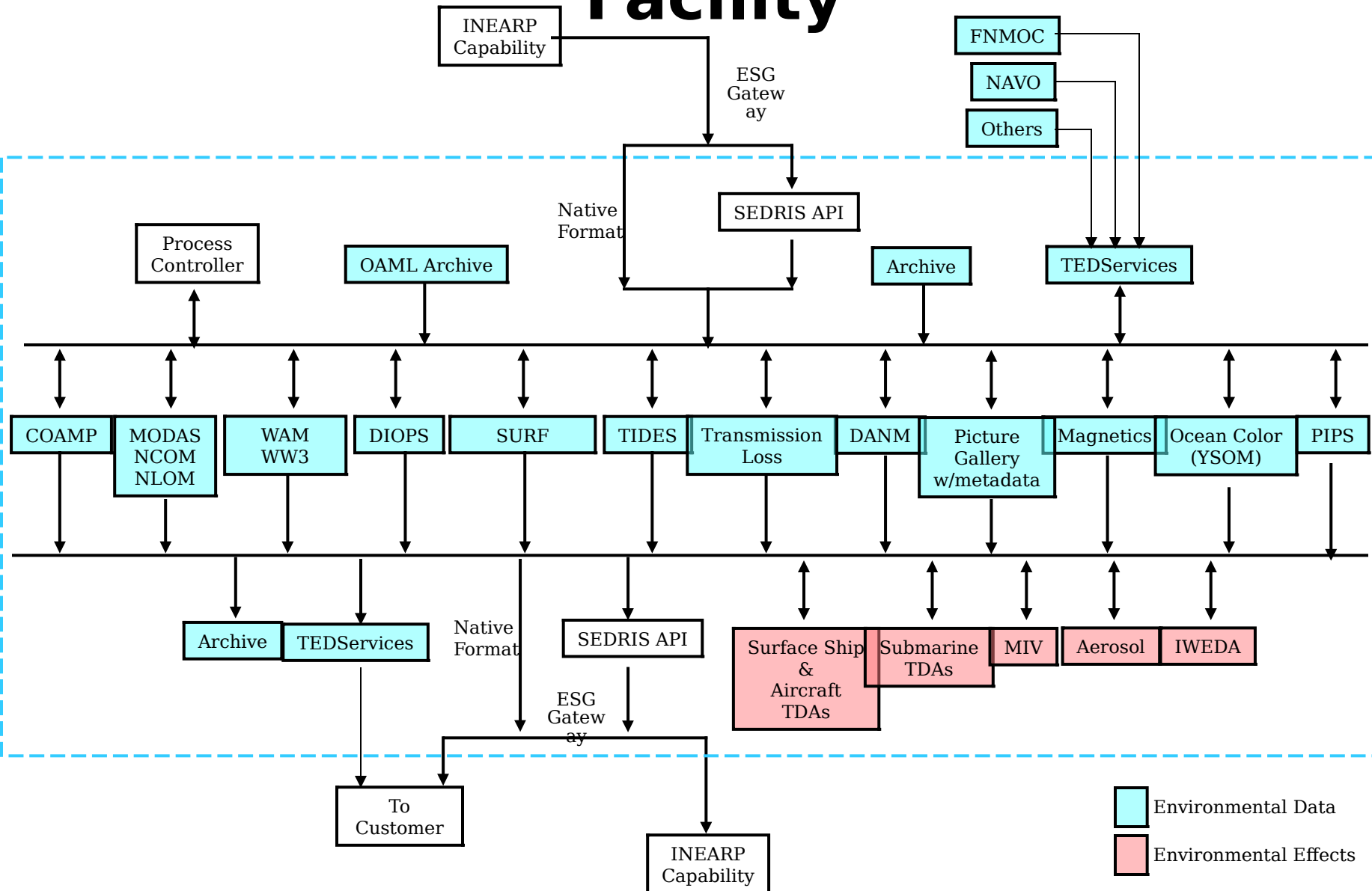


Joint METOC Simulation Service Center *Layout*

M&S Customer Examples



Facility



Oceanographic & Atmospheric Master Library (OAML)

A library of oceanic, atmospheric and acoustic models, databases and algorithms.

- **58** Navy Standard Core Models, Databases, and Algorithms
 - (19) Data Bases; (32) Models; (7) Algorithms
 - **25** Presently Approved For Development
 - (13) Data Bases; (8) Models; (4) Algorithms

Brief Model Descriptions

Ocean Surface Models

Ocean Sub-Surface Models

	Surf	Tides	WW3	WAM	DIOPS	MODAS	NCOM	NLOM
Description	Produces 2-D analyses and forecasts of sea state and surf conditions					Produces 3-D analyses and forecasts of ocean temperatures		
Used By	Amphib and Spec warfare	Mine, Amphib and Spec warfare	Global/regional, drives shallow water surf model, ship routing, ambient noise for ASW & MIW		Sequentially links above suite of models to provide accurate wave height and near shore predictions	Global ASW	Targeted for littoral warfare (MIW, ASW, Spec warfare)	High fidelity ASW and submarine ops
Input Data	Bathymetry wind	Astronometrics bathymetry	Bathymetry wind			Bathymetry, wind, air temperature, sea surface height, sea surface temperature, ocean temperature and salinity profiles		

Ocean Surface Models

Surf: Surf Model
 Tides: Tidal Model
 WW3: WaveWatch 3
 WAM: Wave Action Model
 DIOPS: Distributed Integrated Ocean Prediction System

Ocean Sub-Surface Models

MODAS: Modular Ocean Data Assimilation System
 NCOM: Navy Coastal Ocean Model
 NLOM: Navy Layered Ocean Model

Brief Model Descriptions

Tactical USW Models

Other Ocean Models

	ASTRAL	PE	CASS	ASPM	Nautilus	DANM	PIPS	YSOM
Description	Produces analyses and forecasts of acoustic transmission loss					Acoustic ambient noise	Produces analyses and forecasts of polar ice edge movement and icecap thickness	Produces analysis of water clarity and swimmer visibility for the Yellow Sea
Used By	Used by all USW forces and USW TDA users						Submarine forces	Mine warfare and Spec warfare
Input Data	Bathymetry, sea state, ocean temperature and salinity profiles, ocean bottom characteristics					Wind, shipping density, bathymetry, ice noise, TL	Atmospheric temperature, wind precipitation, ocean temperature, salinity and currents, SSM/I imagery	Ocean currents, bathymetry, ocean bottom sediment type, archived optics measurements, winds, SeaWiFS ocean bio-optics, MODAS temperature profiles

Tactical USW Models

ASTRAL: Active or passive Automated Signal Excess Prediction System (ASEPS) Transmission Loss Model

PE: Passive Parabolic Equation Transmission Loss Model

CASS: Active Comprehensive Acoustic Simulation System Transmission Loss Model

ASPM: Active System Performance Model for Transmission Loss

Nautilus: Passive low frequency Transmission Loss Model

DANM: Dynamic Ambient Noise Model

Other Ocean Models

PIPS: Polar Ice Prediction System

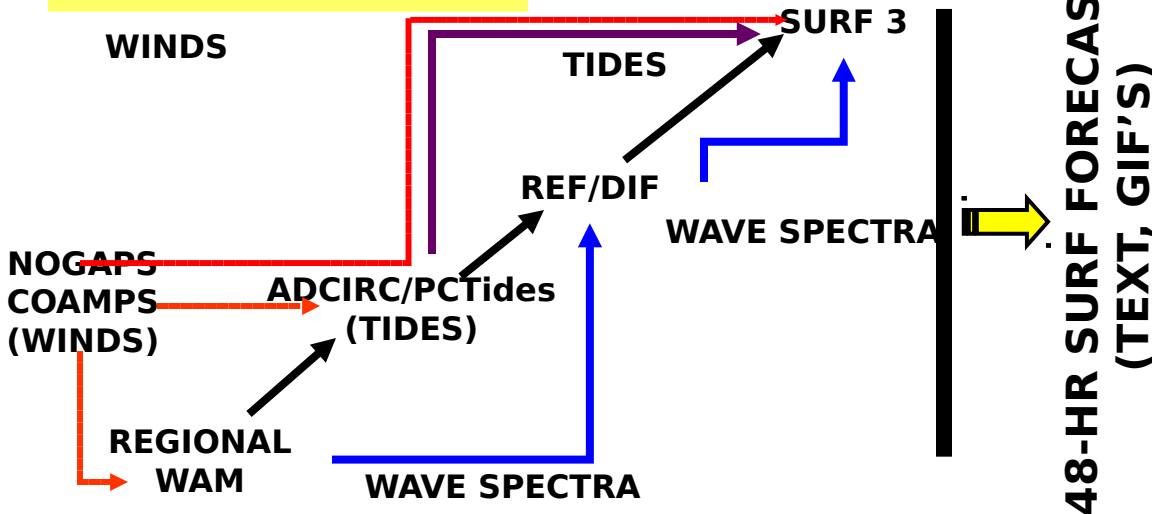
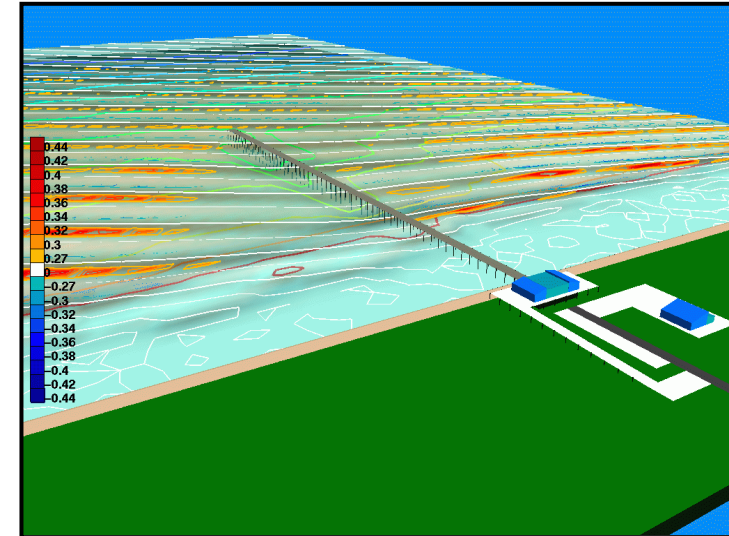
YSOM: Yellow Sea Optical Model

Distributed Integrated Ocean Prediction System (DIOPS)

Provides a physically consistent representation of the ocean surface from the open ocean to the surf zone.

Products include:

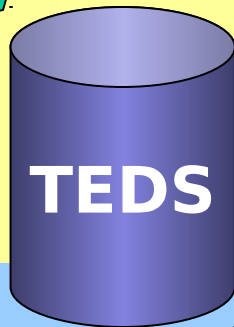
- Wave Height and direction
- Wave-current interaction
- Significant wave height
- Significant breaker height
- Peak period
- Tides
- Breaker period
- Breaker Type:
 - Spilling, Plunging, Surging
- Breaker angle
- Surf zone width
- Longshore current
- Modified Surf Index



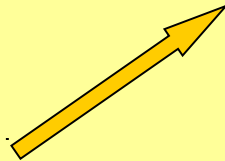
Linking Operations and Simulation

LIVE

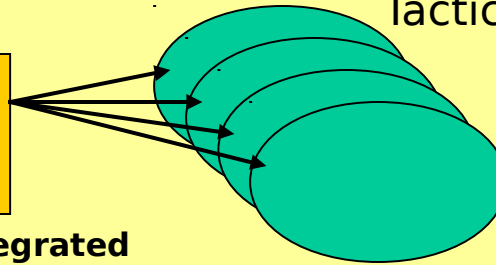
Operational
METOC Data



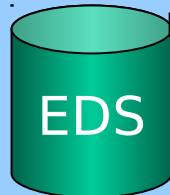
Tactical
Environmental
Data
Services



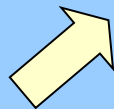
Naval Integrated
Tactical
Environmental
System



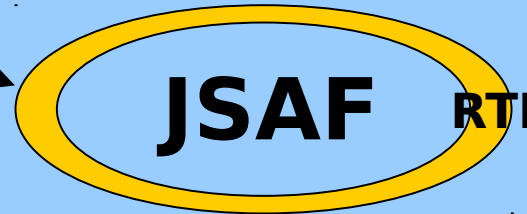
Individual
Tactical Decision Aids



Environmental
Data Server
(OASES)



Ocean Model Data/ESG



SIMULATION

TEDServices/OASES/ESG/Data

IDEF0 Model

(Under Construction)



<http://quickplace.hq.navy.mil/msea-ocean>

Modeling & Simulation Executive Agent for Ocean Representation

home

go:

- Welcome
- General Information
- MSEA(Ocean)
- Discovery:
- Document Library
- Related Links
- Index

tools:

news: daily | weekly
sign in | print | tutorial |
help

WELCOME TO THE DEPARTMENT OF DEFENSE MODELING & SIMULATION EXECUTIVE AGENT (MSEA) FOR OCEAN REPRESENTATION WEB SITE



What's Inside

General Information

- Administrative Information such as points of contact and mailing address
- Directions to the U.S. Naval Observatory (USNO)
- Privacy and Security Disclaimer

MSEA (Ocean)

Sign in
by
clicking
here

[new...](#)[edit](#)[check out...](#)

go:

[\[Go Back\]](#)[▶ Instructions](#)[Room Index](#)[Room Options](#)[Room Security](#)

tools:



advanced search

news: daily | weekly

chat | notify | print |

tutorial | help

Environmental Scenario Generator - TEDServices IDEF0 Model

(Under Construction)

The purpose of this site is to provide a common work area for the development of the ESG-TEDServices IDEF0 model. This IDEF0 model will lay out the architecture needed for constructing the interfaces needed for TEDServices to work with the INEARP.

Participants in this IDEF0 model development include:

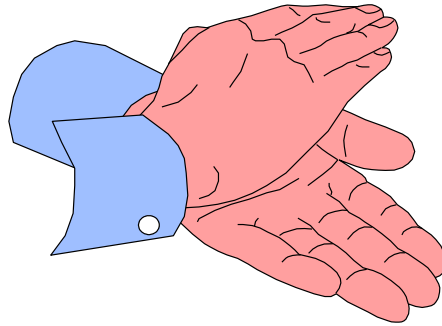
- Pat Kelley, PMW 150 (TEDServices)
- Steve Lowe, SAIC (ESG)
- Paul Foley, DMSO (INEARP)
- Ed Weitzner, N096 (Ocean MSEA)
- Others

Additions, corrections and suggestions to the work being done here can be made by dragging the attached PowerPoint files to your desktop, making your changes, and dragging the selected file(s) back to this site under in the "Edit" mode. Directions for doing this are below.

You can download any of the files below by dragging them to your Windows desktop. To open a file for reading, double-click it.

IDEF Model
Description....INEARP IDEF0
Model.ppt

Thank You



Ed Weitzner

Office of the Oceanographer of the Navy, OPNAV N960F1

Modeling & Simulation Executive Agent for Ocean Representation

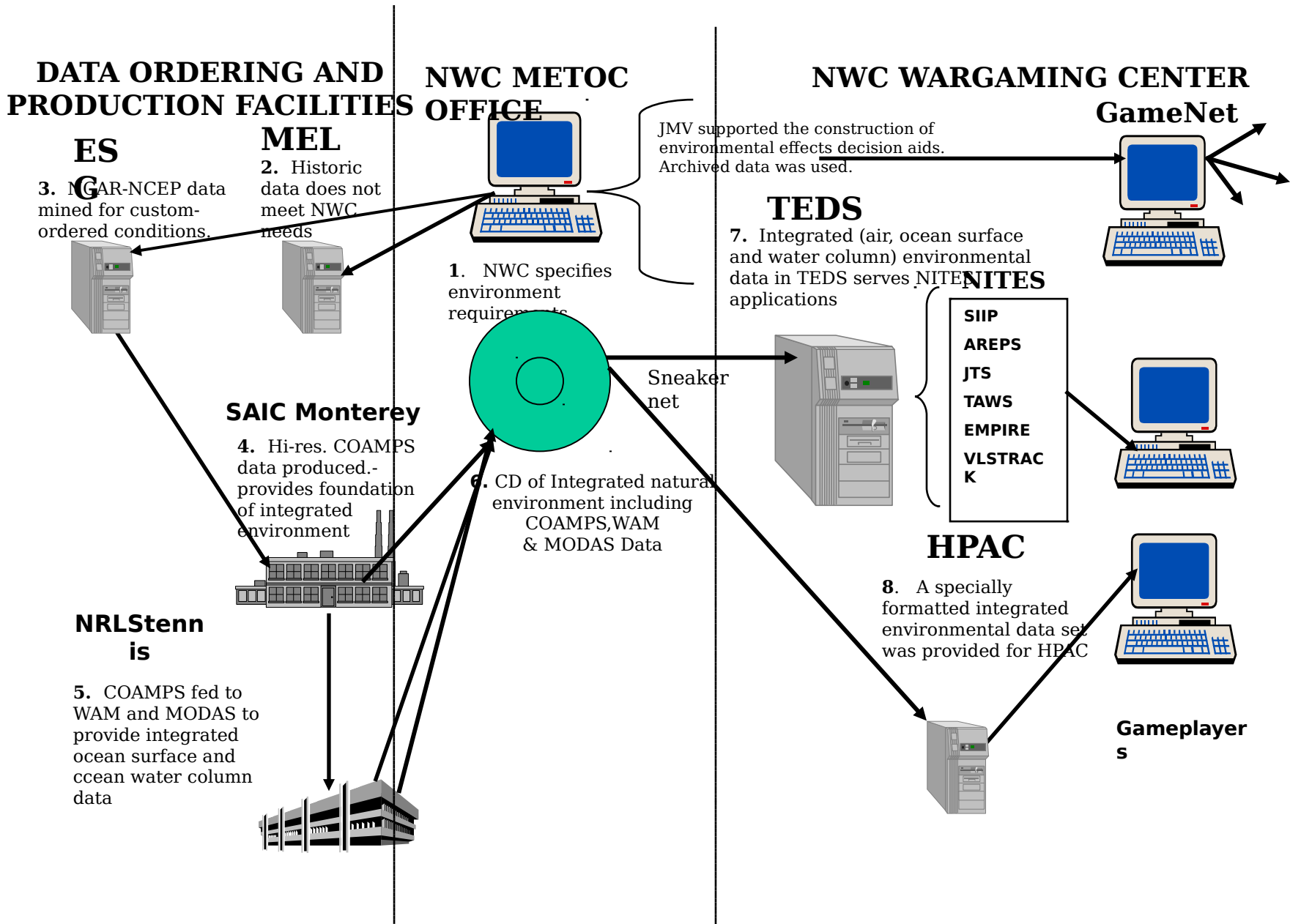
Edward.Weitzner@Navy.Mil

202-762-0264

<http://quickplace.hq.navy.mil/msea-ocean>

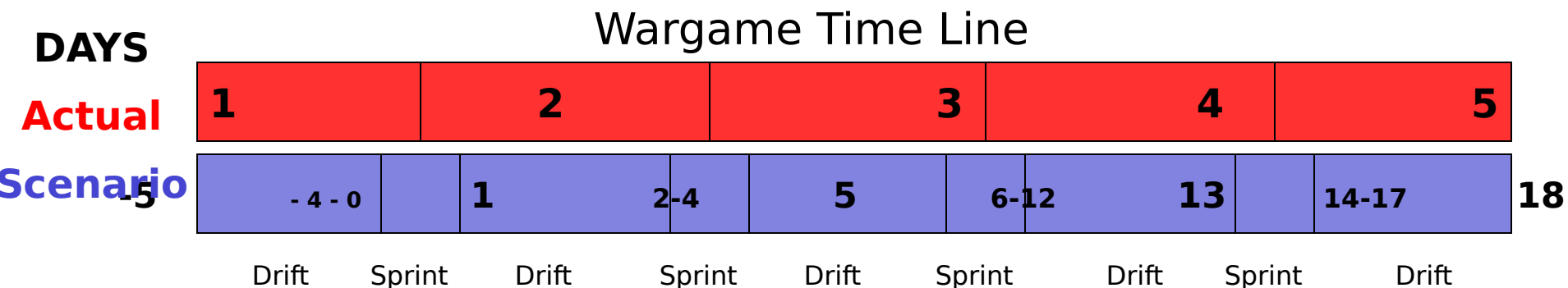
Support to the Naval War College Global War Games

GLOBAL 2000 METOC Information Flow

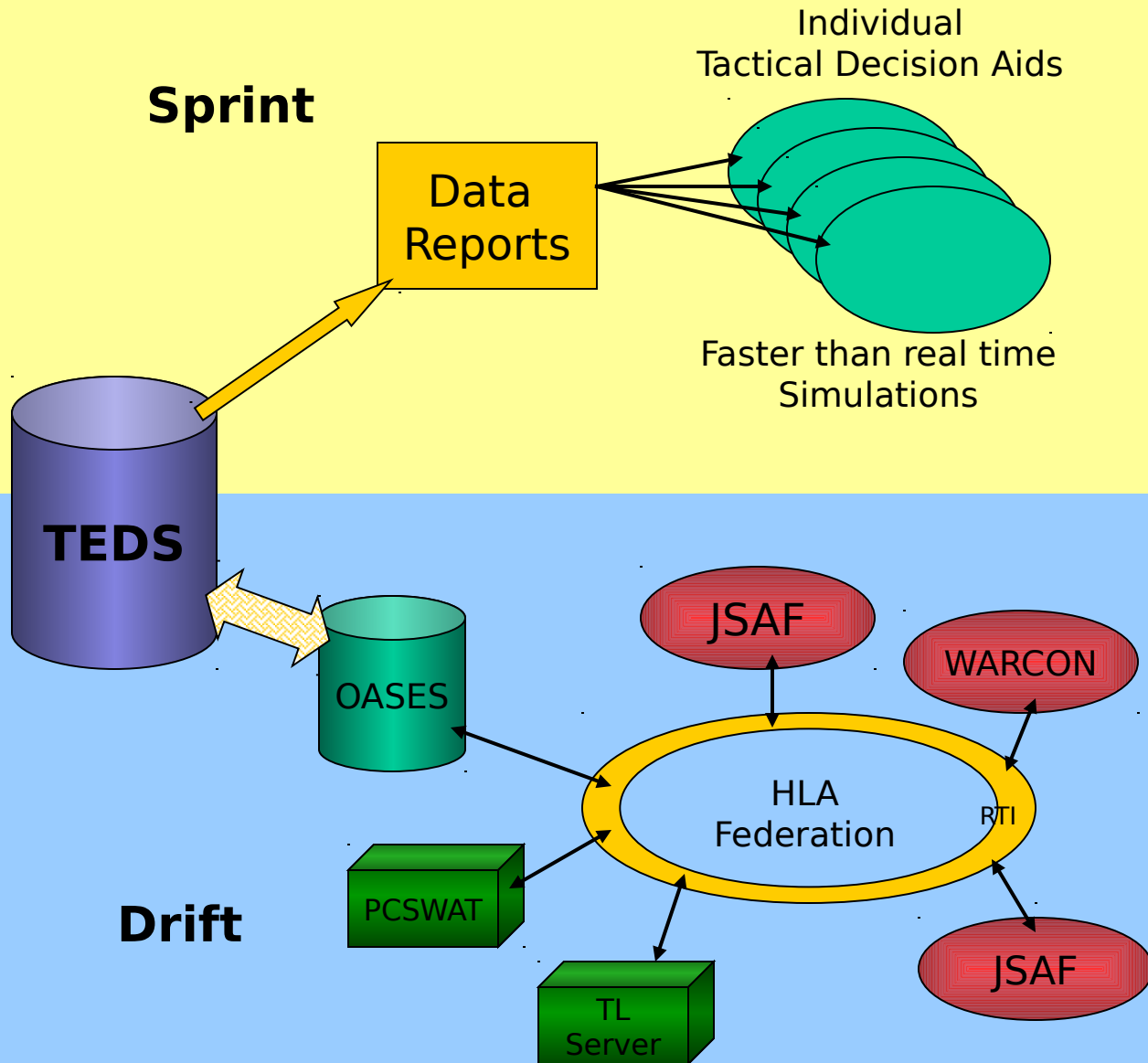


Global '01 Experience

- Compress time through Sprint & Drift
 - Intent: play several weeks in 4-5 days
- Sprint: faster than real time over night
 - Play environmental “snapshots”
 - Typical or extremes of interest
- Drift: real time play during daytime hours
 - Play hourly environmental changes computed for each “snapshot”



Environmental Data Delivery and Interpretation

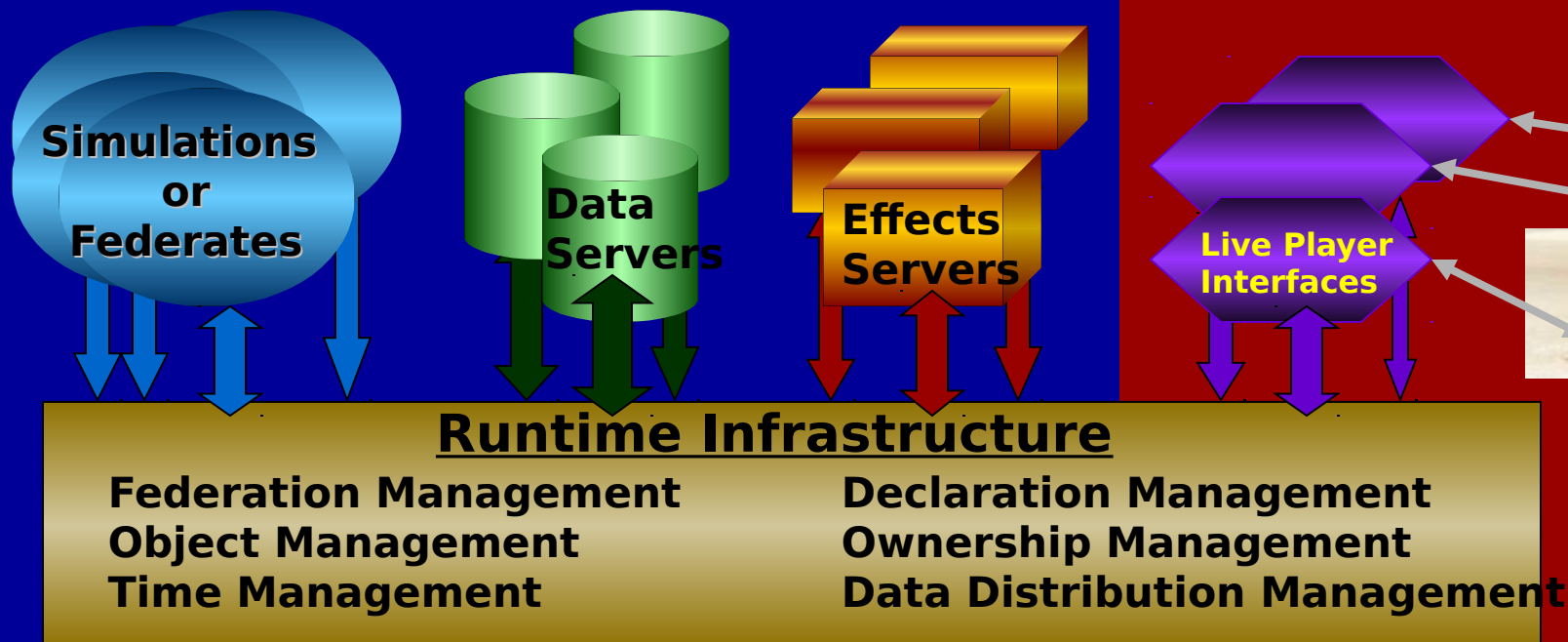


- **Sprint**
 - Snapshots only
 - Minimal data use
 - Limitations of TDAs and simulations
- **Drift**
 - Hourly METOC consistent with snapshots
 - OASES delivers data to all federates
 - Servers mediate effects to federates.

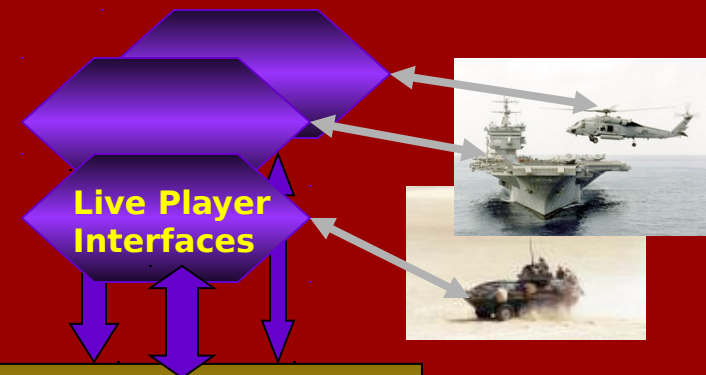
Using a Server Architecture with JSAF

- Exploit the HLA to use environmental data server
- Develop effects servers to enable consistency
- Address constructive wargames and experimentation

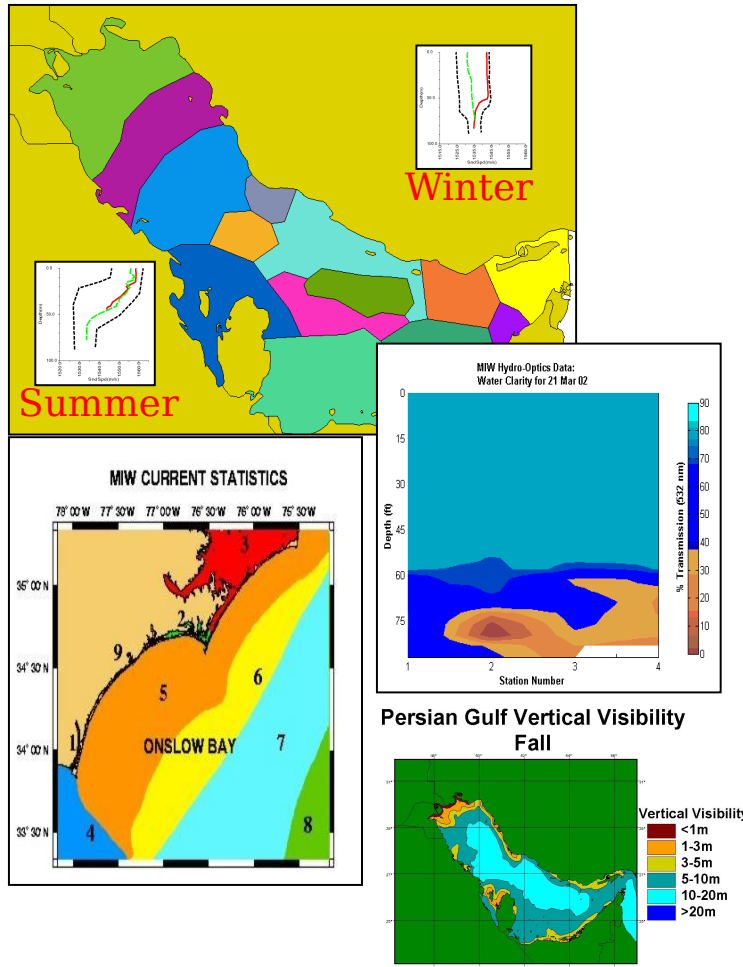
Common Elements



Experimentation

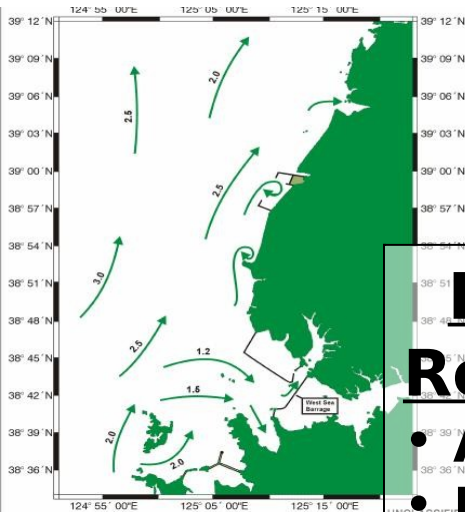


Mine Warfare Littoral Environmental Databases



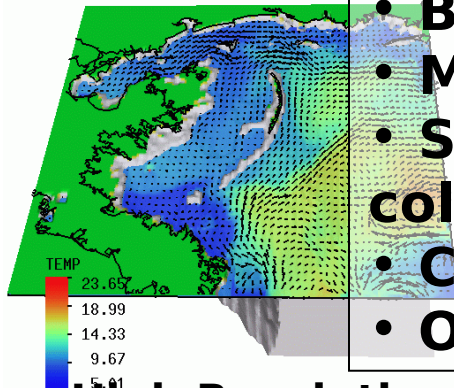
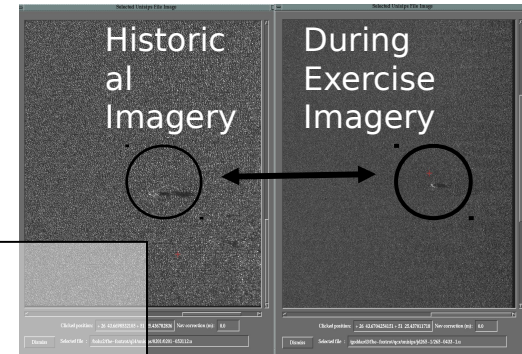
- Temperature/Salinity/SSP
 - 8 Million Profiles World-Wide.
- Currents
 - Provinced Current Speed by Season.
 - Major Forcing Functions Which Effect Current Speed
- Optics
 - ~ 400,000 Profiles Optical Profiles World-Wide
- Bathymetry
 - Worldwide varying resolutions

Database Resolution

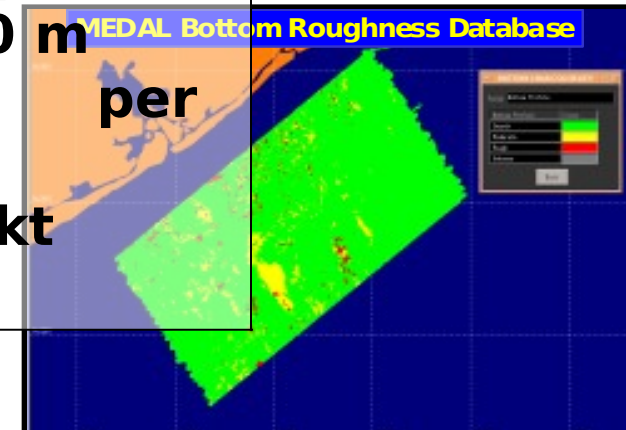


Element: Resolution

- **Acoustic Imagery:** < 10 cm
- **Bathymetry:** 20 m/2% depth
- **Bottom Sediments :** 100 m/0.003mm
- **Bottom Roughness:** 100 m/<10 cm
- **Bottom Clutter:** 100 m/ 3 per NM
- **Mine Burial:** 100 m
- **SVPs:** collection plan
- **Currents:** 100m/0.5kt
- **Optics:** TBD

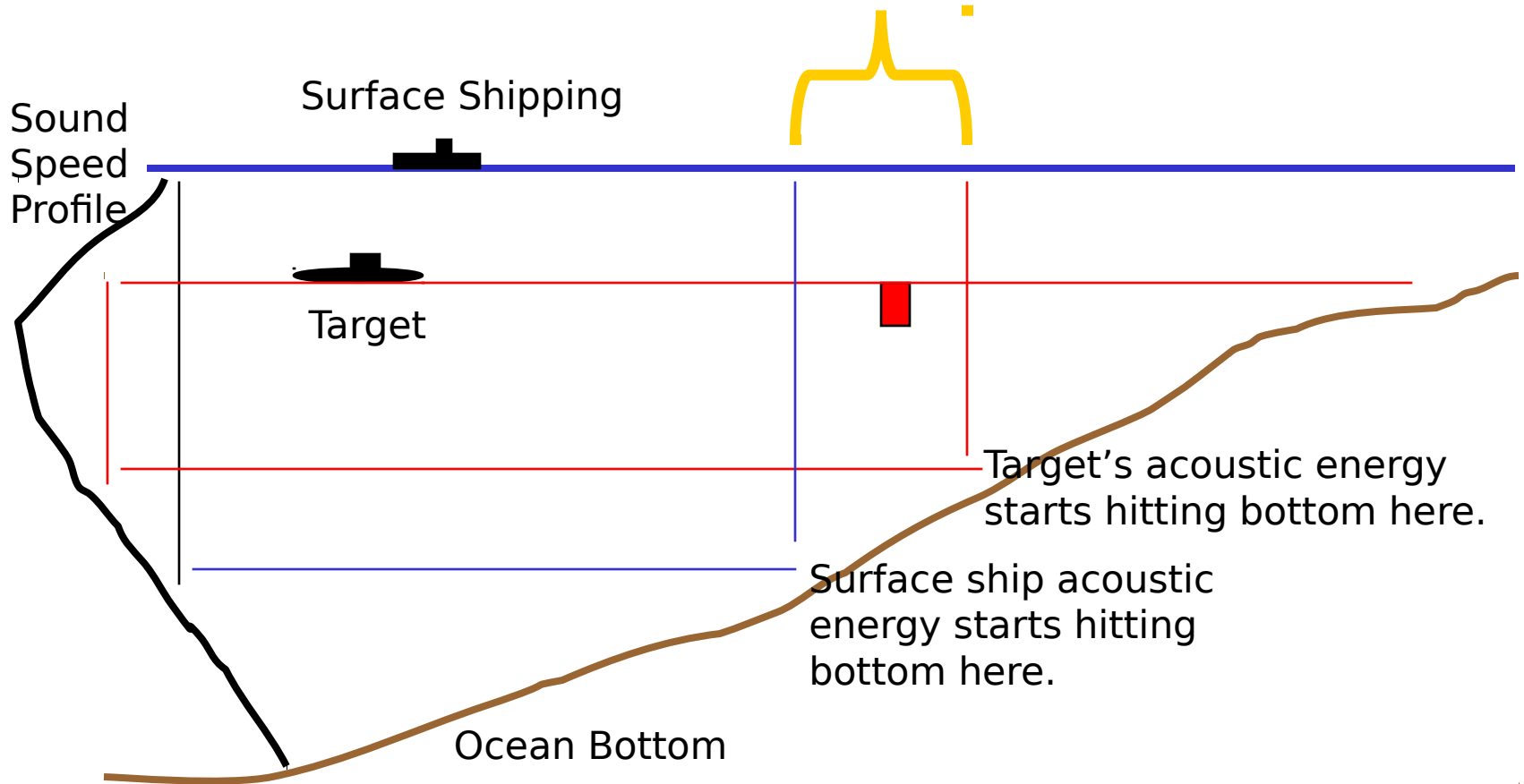


**High Resolution
Coastal Currents**



Topographic Noise Stripping

Put acoustic sensor in vicinity of red block.



Joint Thresholding Segment METOC Queries

